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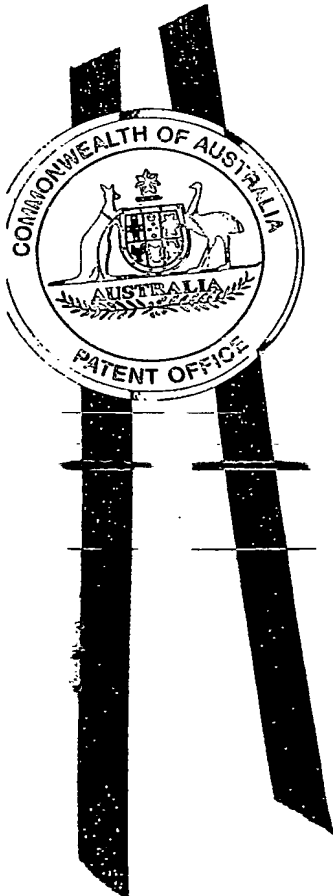
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I, LEANNE MYNOTT, MANAGER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2003906581 for a patent by FLEXTANK PTY LTD as filed on 28 November 2003.

WITNESS my hand this  
Seventh day of December 2004

A handwritten signature in black ink, appearing to be 'LM' or similar initials.

LEANNE MYNOTT  
MANAGER EXAMINATION SUPPORT  
AND SALES



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**PROVISIONAL SPECIFICATION**

**PLASTIC WINE BARREL**

**The invention is described in the following statement:**

# **1. Introduction**

Many red and some white wine varieties are matured in oak barrels, according to the wine variety, quality and desired character.

The general aim of wine aging in Oak barrels, is to develop a desirable aged wine bouquet and character, by:

- controlled and slow oxidation of various wine substances especially the phenolic compounds. This slow oxidation, followed by polymerization, results from limited and gradual exposure to air oxygen diffusing through the walls of the barrel over months.
- Extraction of Oak flavour components, including Oak phenolics to enhance and expand the wine's complexity.

However Oak barrels are expensive to fashion, cumbersome to store and handle, often inconsistent in wood properties, subject to leakage and limited in useful life.

Oak barrels also require a voluminous storage facility with a controlled temperature and humidity environment to minimize evaporative loss due to transpiration through their porous walls.

Accordingly there have been many attempts to replicate the effects of barrel aging on wine, without the actual use of oak barrels. For example:

- The addition of Oak sawdust, chips or staves into metal bulk storage tanks, to expose the wine to Oak characters. However this only achieves the Oak flavour extraction function of barrel aging, not the oxidative one. This can be mitigated to some extent by regularly "pumping over" the wine in the tank, in order to re-aerate it. However this often introduces too much dissolved oxygen all at once, allowing

aerobic bacteria such as *Acetobacter* to become established and begin oxidizing the ethanol in the wine into acetaldehyde, ethyl acetate and ultimately acetic acid, with consequent loss of wine quality. These oxidation products are termed "volatile acidity" in the wine industry.

- The development of composite containers made of metal (stainless steel) and fitted with flat Oak panels or ends which can be more easily fashioned and which may be reversed to expose fresh Oak to the wine contents. Such containers usually don't have the optimum ratio of surface area of Oak to volume of wine contained and are usually inadequate both in the extractive and oxidative functions.

More recent developments include the use of "micro-oxygenation" wherein air or pure oxygen is introduced directly into bulk-tanked wine with added Oak chips, by generating very fine bubbles through the wine by means of a micro-porous (i.e. sintered) dispersion element on the end of a submerged gas line or lines.

This is a difficult process to adequately control and can possibly lead to excess levels of dissolved oxygen at the bubble interfaces, again promoting ethanol oxidation and other degradative side-effects through fast oxidation of wine if not administered correctly. The equipment required to contain and feed fixed volumes of oxygen or to accurately meter a continuous flow over set time periods at very low flow rates, is normally expensive and difficult to operate. That cost also means the resource has to be shared over a number of tanks, which militates against long, slow maturation times in individual tanks.

Recent studies such as reported in "Gaseous Exchange in Wine Stored in Barrels", Moutounet, Mazauric et al, J. Sci. Tech. Tonnellerie, 1998 (herein incorporated by reference) have explained the mechanism by which barrels add oxygen to wine and promote "correct" maturation. The oak walls of wine barrels act as semi-permeable "membranes", allowing oxygen gas in the

atmosphere outside the barrel to permeate through the barrel walls and diffuse into the wine. This osmotic exchange is driven by the partial pressure difference of the atmospheric oxygen outside the barrel (0.18 atm) and the effectively zero partial pressure of oxygen inside. This absence of oxygen in the barrel arises because wine continuously consumes all available oxygen in the slow-oxidation reactions that occur in the reductive environment that exists when the rate of oxygen addition occurs at very low rates over long periods, due to slow diffusion.

Furthermore, it has been shown that it is this slow permeation (diffusion) of atmospheric oxygen that contributes *most* to "barrel softening or maturation". Moutounet et. al. (referred to above) showed that a typical new oak barrique allows O<sub>2</sub> permeation through its walls, in the range of 15-20ml/l/yr. Kelly and Wollan report an estimated "highest diffusion (i.e. permeation) rate" into a typical barrique as 2.2ml O<sub>2</sub>/litre wine/month or 26.4 ml/l/yr in their paper "Micro-oxygenation of Wine in Barrels", Wine Network Technology, [www.winenet.com.au](http://www.winenet.com.au), incorporating International Patent Application PCT/AU02/01250 (both herein incorporated by reference)

Kelly and Wollan further report that adding extra O<sub>2</sub> by racking only contributes about 4 ml/l. for each racking. They also report that repeated topping combined with the oxygen dissolved into wine from the average level of headspace that exists in a barrel between toppings, only adds about 5 ml/l/yr of additional oxygen.

Any free surface arising from head-space in a wine storage vessel is undesirable, if it contains oxygen. At that surface the levels of dissolved oxygen increase in concentration, to near saturated (9 ppm at 20 Celsius and 1 atm.). In this oxygen rich surface layer aerobic bacteria will propagate, generating volatile acidity and acetaldehyde at a rate dependent usually on the surface area of the free surface and the oxygen content of the surface gas. The lesser the free surface area, the longer that wine can be safely kept in bulk storage.

## 2. Description

Accordingly we have now developed a method and apparatus which achieves the simultaneous extractive and slow-oxidative effects of Oak barrel aging without the need to use such barrels or to add extra oxygen gas or air into the wine.

Furthermore the method of our invention allows the independent adjustment of both the degree of Oak extraction and the degree of slow-oxidation. In this way it is possible to replicate the different extractive and oxidative effects of Oak casks with different surface area to volume ratios. Common Oak cask sizes are Barriques (225 litres), Hogsheads (300 litres) and Puncheons (500 litres).

One embodiment of the apparatus of our invention is illustrated in Fig. 1, herein. This shows an optionally thermally insulated plastic tank (4) with an opening in the top defined by a cylinder (9) forming part of the tank, to which any closure can be fitted (not shown).

In this embodiment an optional outer cylinder (10) is welded to or molded as part of the tank (4) and an optional base valve (8) is fitted through the side wall, above the base of the tank so as to enable bottom filling or discharge of the tank contents without disturbing sediment that may have settled to the bottom of the tank.

In this embodiment the tank (4) is sealed by means of an inverted dome-shaped cover (1) that is partially submerged in a water trap (2) formed by adding water to the space between the two concentric cylinders (9) and (10).

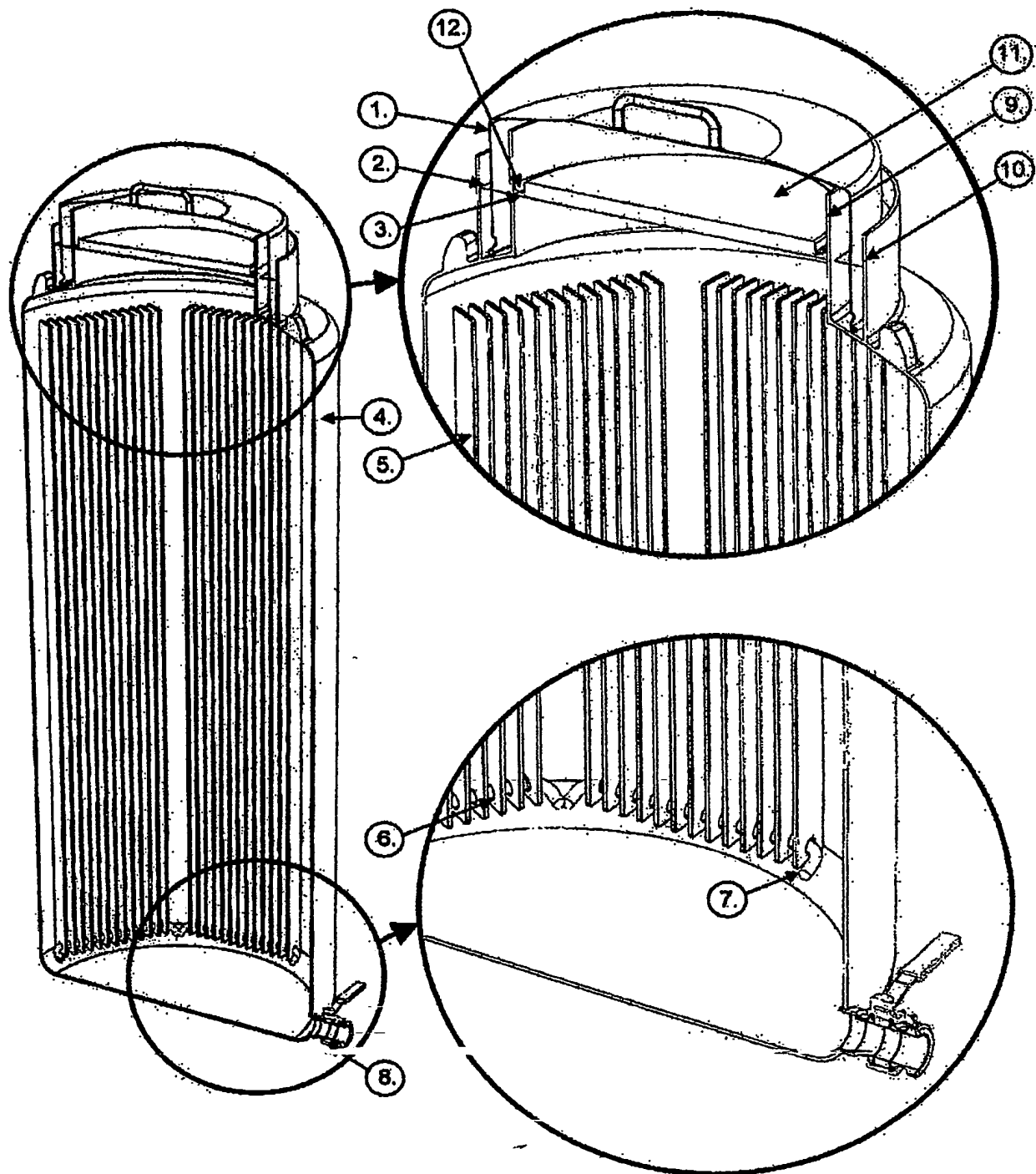
The tank (4) and top cylinders (9) and (10) are to be made from polyethylene with an oxygen permeability in the range between 50 to 300 ml. of oxygen per sqm of tank surface per 24hr per atm for each 1mm of tank wall thickness at typical storage temperatures of 20-25 degr C.

The ratio of contained volume to surface area of said container is to fall within the range 5 to 30 litres per square meter of surface for each 1mm of thickness, to ensure that an adequate rates of permeation of oxygen is maintained.

Suspended within that wine-filled tank are an optional number of oak-wood staves (5) of the desired variety and degree of toast (i.e. charring). At the lower end of each stave a hole (6) is drilled to enable that stave to be threaded onto or otherwise attached to a solid rod (7) usually made of stainless steel, which is sufficiently heavy to keep all of the wooden staves attached to it from floating to the surface. The total surface area of oak-wood presented to the wine will depend on the variety of wine, the degree to which the winemaker wants to impart oak character to it and the number of times the oak staves have already been used in wine.

In this embodiment, the stainless steel rod (7) is bent into a "U" shape, so that the ends hang downwards and the staves float upwards. By this simple means the staves are prevented from floating off the ends of the rod (7).

The level of wine (3) in the tank will normally lie within the top cylindrical chamber formed by the cylinder (9). Resting or floating on that wine surface is an optional buoyant disc (11) made of wine-safe polymer such as polyethylene or a composite structure that may comprise a disc of plastic foam overwrapped and sealed within a wine-safe film of pre-determined oxygen barrier properties. The outer perimeter of said buoyant disc may optionally be furnished with a flexible lip (12) which forms a "wiper seal" with the inner face of the chamber cylinder (9). The purpose of said buoyant disc is to lie in and block the free wine surface from access to the headspace air or gas in the chamber (9). The disc minimizes the rate at which particular gases in the head space, such as oxygen, can dissolve into the wine via the free surface.



**FIG 1.**



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